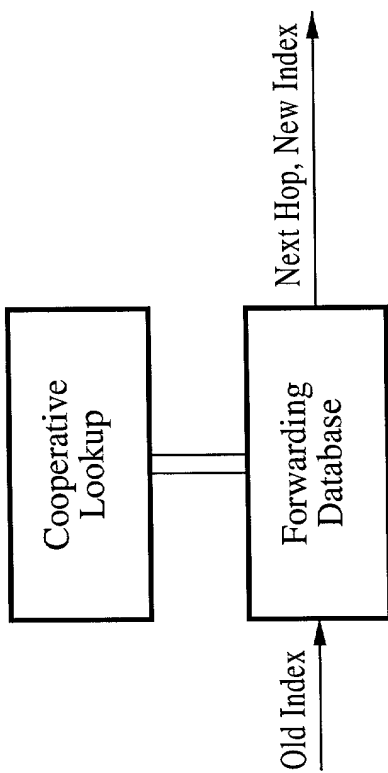


**FIG. 1**



**FIG. 2**

T	Schemes	Applicability	Lookup Time	Memory	Update Time	Multicast
N	Patricia	1st, 2nd upto Last Hop Router	$O(\log(n))$	Low	Low	No
O	DP Trie	1st, 2nd upto Last Hop Router	$O(\log(n))$	Low	Low	No
N	LPCTrie	1st, 2nd upto Last Hop Router	$O(\log^*(n))$	High	Low	Yes
C	Lulea	1st, 2nd upto Last Hop Router	$<< O(\log(n))$	Low	High	No
O	CAM	1st, 2nd upto Last Hop Router	$O(1)$	-	High	Yes
P	DRAM	1st, 2nd upto Last Hop Router	$O(1)$	High	High	No
C	Tag Switching	2nd upto Last Hop Router	$O(1)$	High	High	Yes
O	MPLS	2nd upto Last Hop Router	$O(1)$	High	High	Yes
P	IP Switching	2nd upto Last Hop Router	$O(1)$	High	High	Yes
H	CLUE	2nd upto Last Hop Router	$O(1)$	High	Low	No

FIG. 3

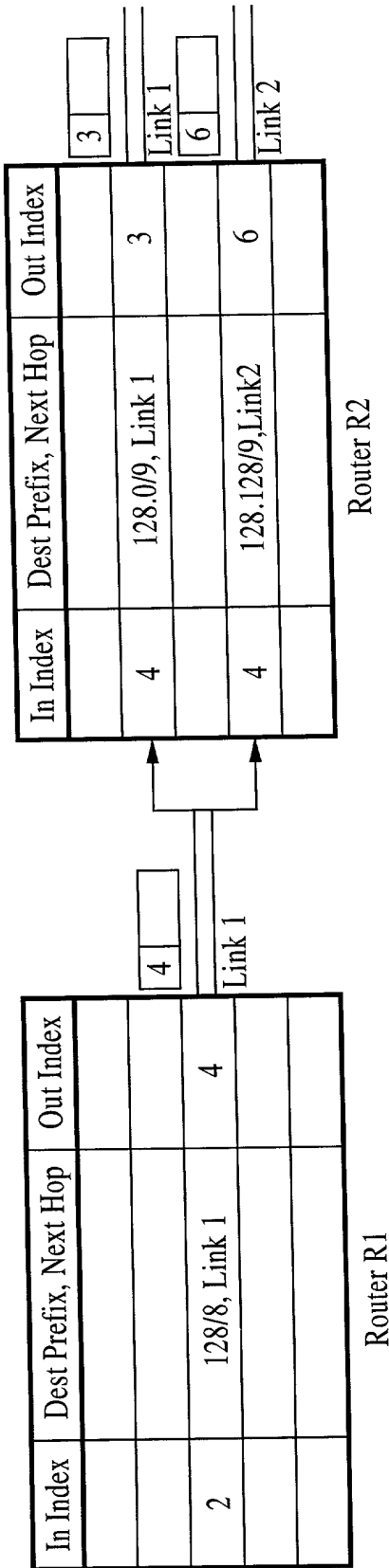


FIG. 4

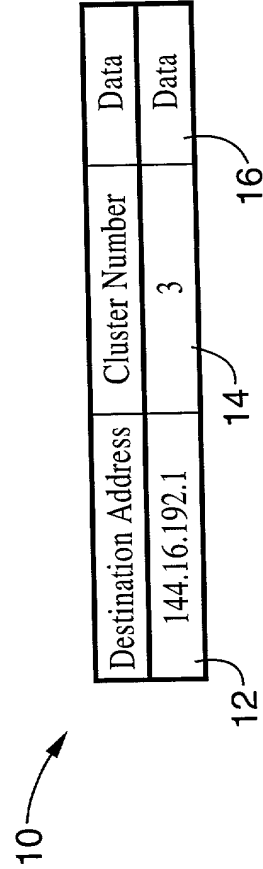


FIG. 5

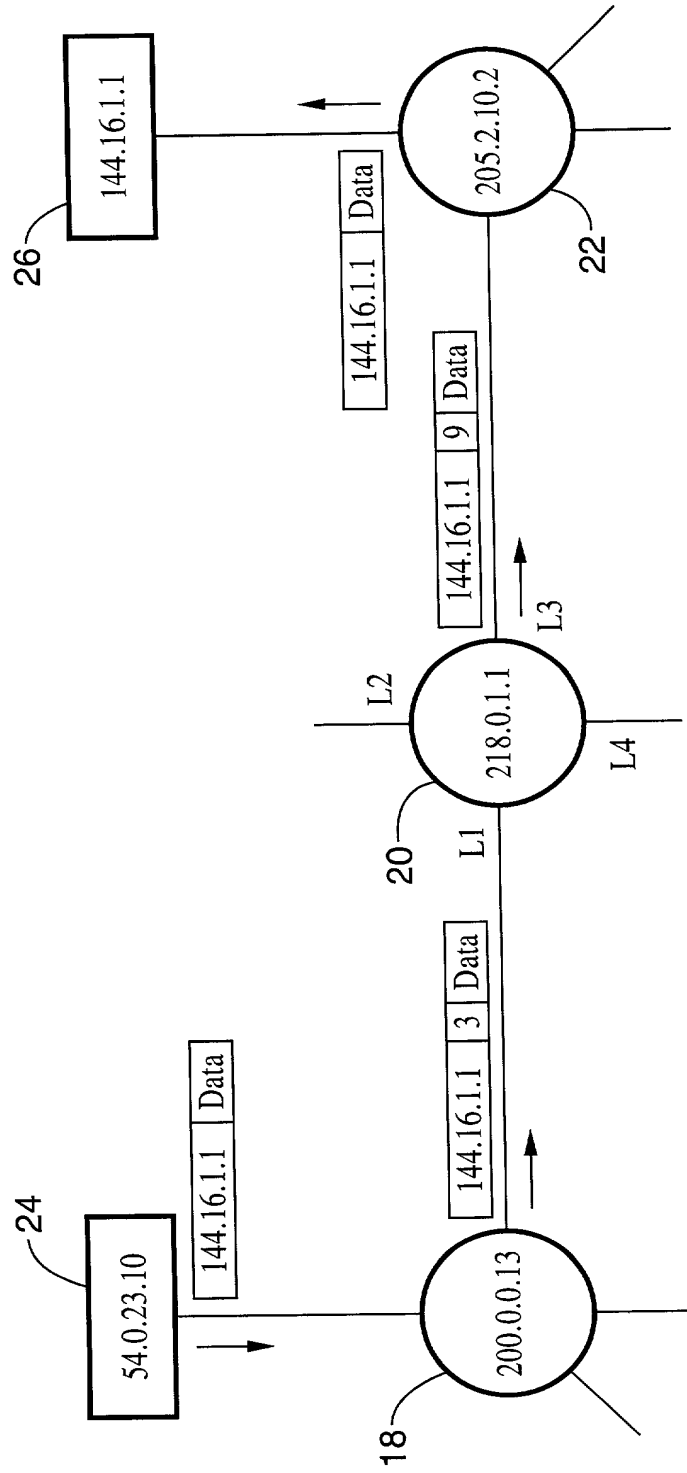


FIG. 6

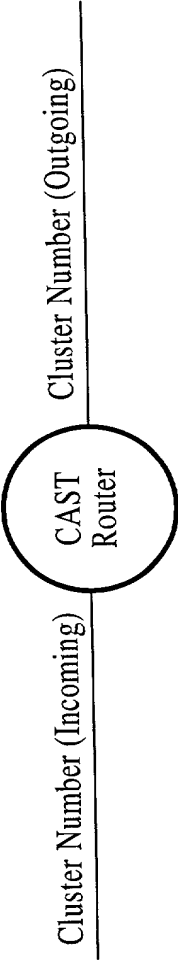


FIG. 7

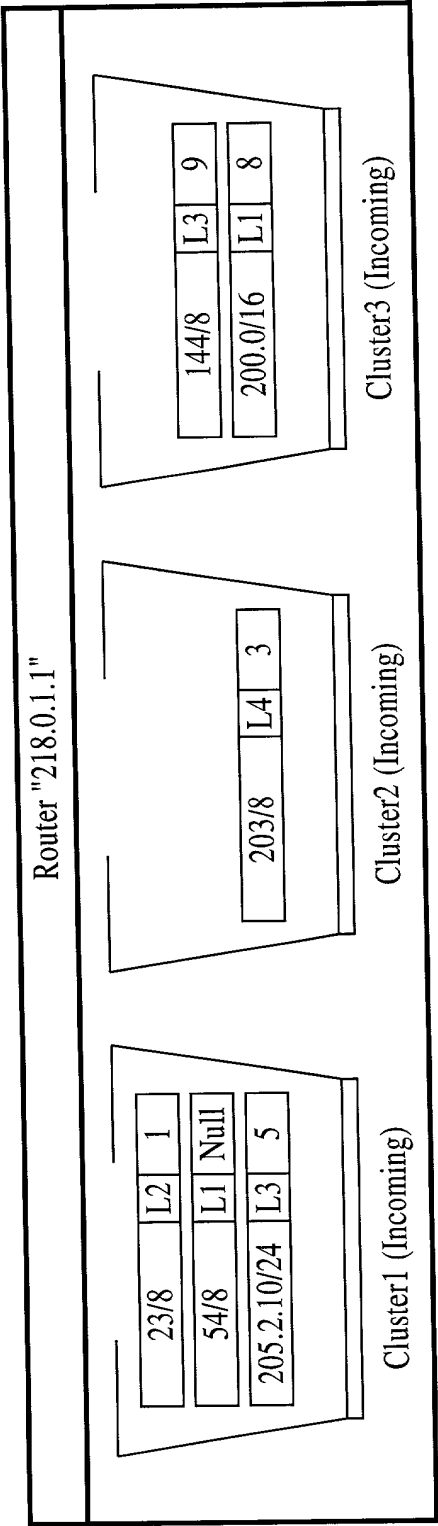


FIG. 8

Prefix Entry	Next Hop Link	Cluster Number (Outgoing)
144/8	L3	9

FIG. 9

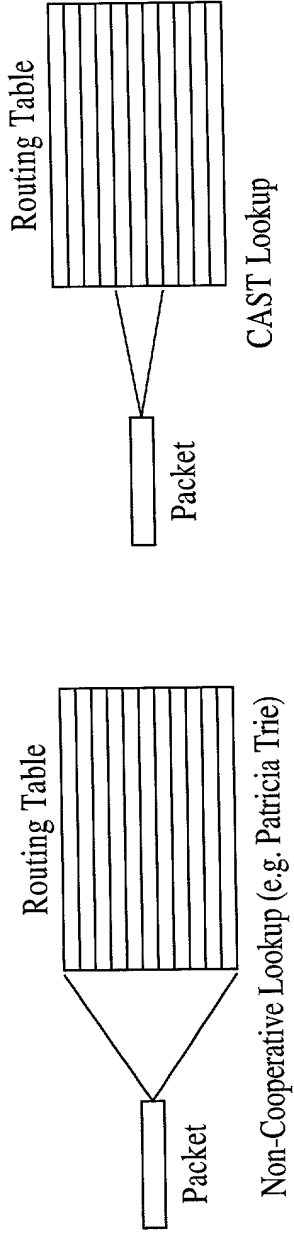


FIG. 10A

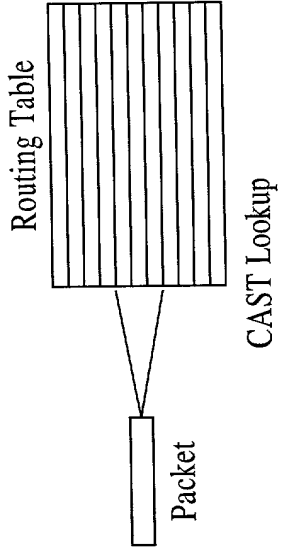


FIG. 10B

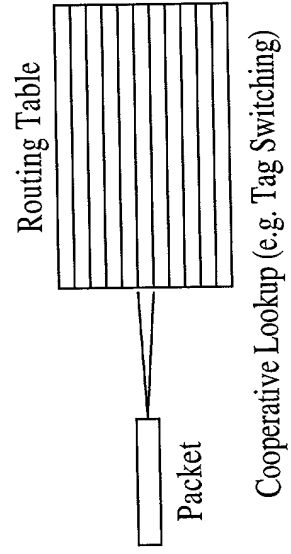


FIG. 10C

Technique	Applicability
Patricia	2nd upto Last Hop Router
Symmetric	1st, 2nd upto Last Hop Router
Link	2nd upto Last Hop Router

FIG. 11

Prefix	Next Hop Link	Cluster Number (Outgoing)
0000*	L2	2
00010*	L3	3
00011*	L2	2
1000*	L1	4
100100*	L2	1

FIG. 12

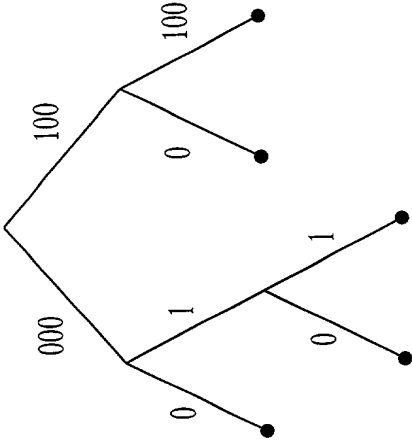


FIG. 13

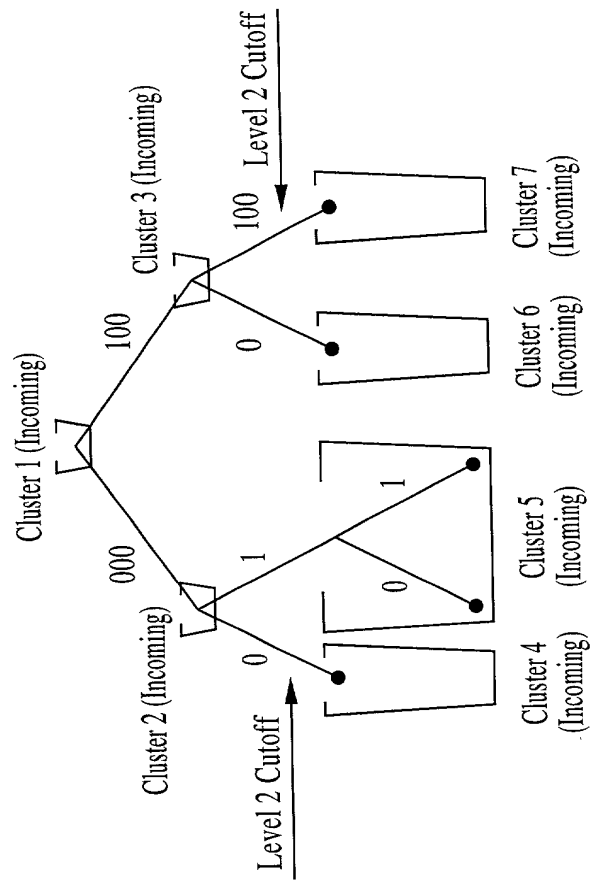


FIG. 15

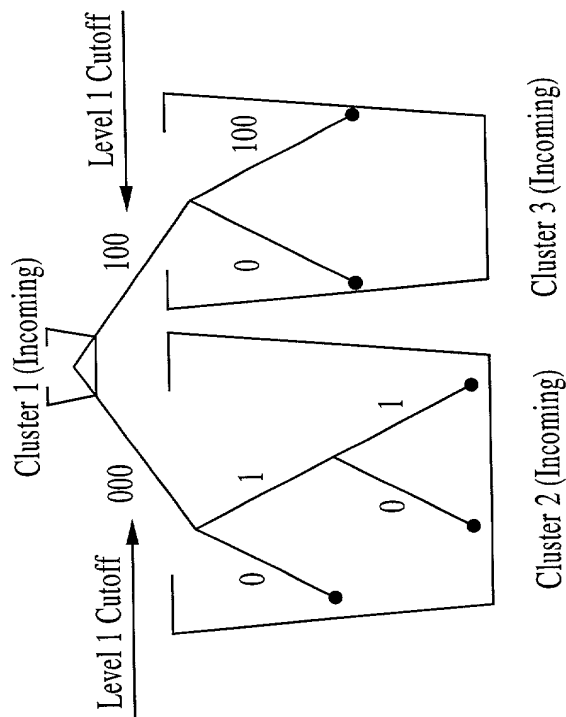


FIG. 14



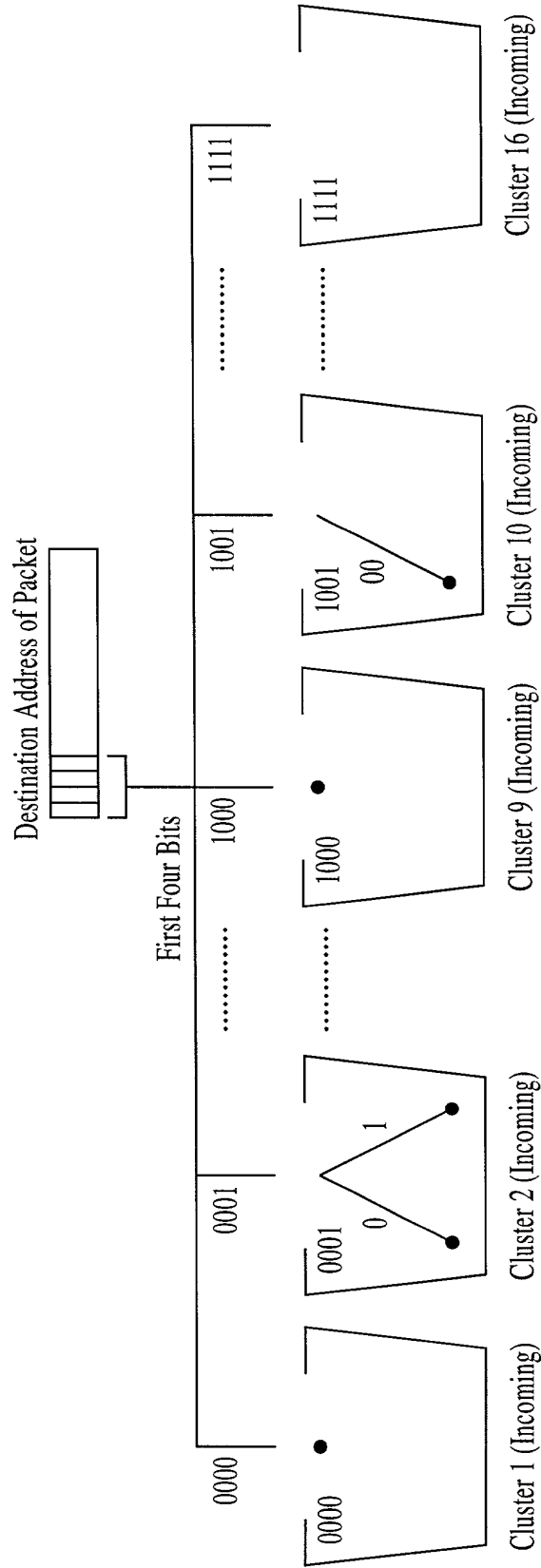


FIG. 16

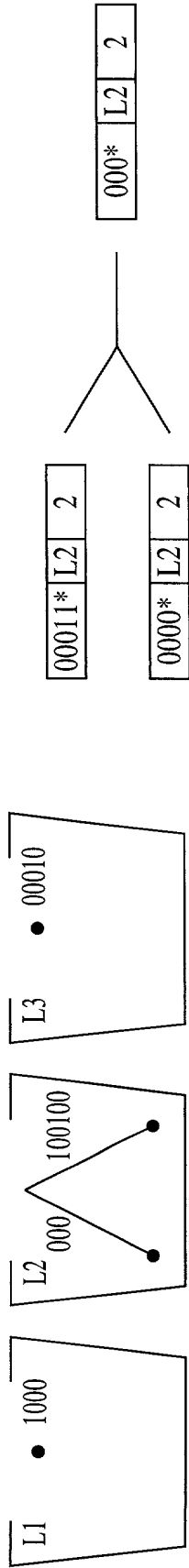


FIG. 17

FIG. 18

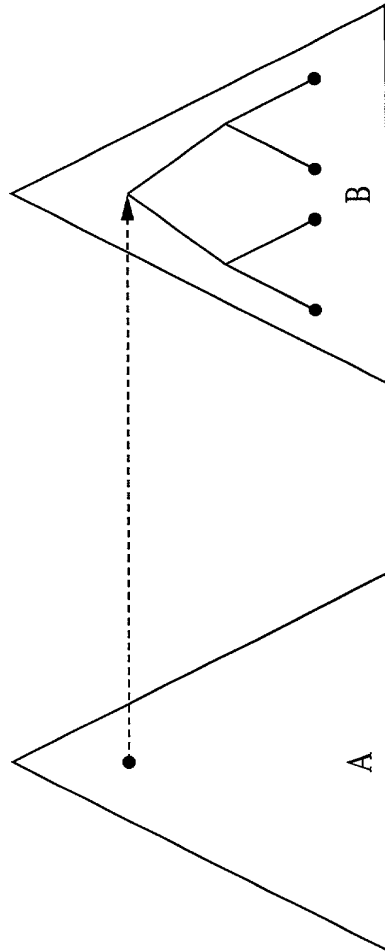
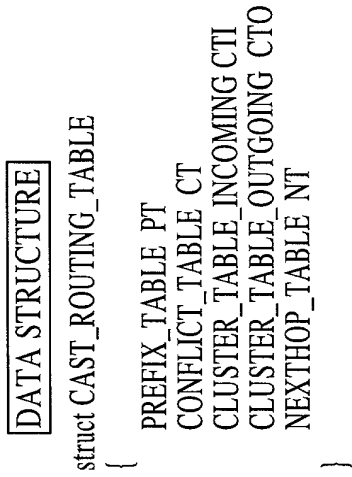
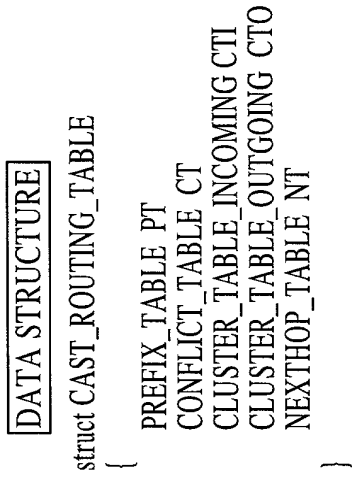


FIG. 19

FIG. 20A



TABLES

PREFIX TABLE			
CHILD	PREFIX	SKIP	POINTER (TO LEFT CHILD OR CLUSTER TABLE (OUTGOING) OR CONFLICT TABLE)
1 bit	1 bit	5 bits	17 bits
⋮	⋮	⋮	⋮

CONFLICT TABLE	
POINTER (TO LEFT CHILD)	POINTER (TO CLUSTER TABLE (OUTGOING))
⋮	⋮
15 bits	17 bits

CLUSTER TABLE (INCOMING)
PATRICIA START LENGTH
⋮
5 bits

CLUSTER TABLE (OUTGOING)	
CLUSTER NUMBER (OUTGOING)	POINTER (TO NEXT HOP TABLE)
⋮	⋮
17 bits	7 bits

NEXTHOP TABLE
NEXTHOP
⋮
32 bits

FIG. 20B

```

Procedure: CAST_Forward_Packet(Packet packet)
Upon receiving an unicast packet this procedure is called in a CAST router
begin
    if((packet.cluster.no.incoming = 'Null') or packet.cluster.no.incoming doesn't exist) then
        cluster_no_symmetric ← Binary to decimal(packet.destination, symmetric_start_length)
        pointer_cluster_outgoing ← Search_prefix_table(cluster_no_symmetric, symmetric_start_length, packet.destination, PT, CT)
        cluster_no_outgoing ← CTO[pointer_cluster_outgoing].cluster_no_outgoing
        pointer_nexthop ← CTO[pointer_cluster_outgoing].pointer_nexthop
        nexthop ← NT[pointer_nexthop].nexthop
        Sendpacket (cluster_no_outgoing, nexthop)
    else
        patricia_start_length ← CTI[packet.cluster.no.incoming]
        pointer_cluster_outgoing ← Search_prefix_table(packet.cluster.no.incoming, patricia_start_length, packet.destination, PT, CT)
        cluster_no_outgoing ← CTO[pointer_cluster_outgoing].cluster_no_outgoing
        pointer_nexthop ← CTO[pointer_cluster_outgoing].pointer_nexthop
        nexthop ← NT[pointer_nexthop].nexthop
        Sendpacket (cluster_no_outgoing, nexthop)
    endif
end

```

FIG. 20C

```
struct CAST_ROUTING_TABLE
{
    LINK_PREFIX_TABLE PT
    CONFLICT_TABLE CT
    CLUSTER_TABLE_INCOMING CTI
    CLUSTER_TABLE_OUTGOING CTO
}
```

FIG. 21A

TABLES

CLUSTER TABLE (INCOMING)	
NEXTHOP	POINTER (TO LINK-PREFIX TABLE)
⋮	⋮
32 bits	17 bits

CONFLICT TABLE	
POINTER (TO LEFT CHILD)	POINTER (TO CLUSTER TABLE (OUTGOING))
⋮	⋮
15 bits	17 bits

FIG. 21B

LINK-PREFIX TABLE		
CHILD	PREFIX	SKIP
⋮	⋮	⋮
1 bit	1 bit	5 bits
CLUSTER TABLE (OUTGOING)		
CLUSTER NUMBER (OUTGOING)		
⋮		
8 bits		

# ALGORITHM

```

Procedure: CAST_Forward_Packet(Packet packet)
Upon receiving an unicast packet this procedure is called in a CAST router
begin
    nexthop          ← CTI[packet.cluster_no_incoming].nexthop
    pointer_link-prefix_table ← CTI[pointer_cluster_outgoing].pointer_link-prefix_table
    pointer_cluster_outgoing ← Search_link-prefix_table(pointer_link-prefix_table, 0, packet.destination, PT, CT)
    cluster_no_outgoing ← CTO[pointer_cluster_outgoing].cluster_no_outgoing
    Sendpacket (cluster_no_outgoing, nexthop)
end

```

**\*\*Link Clustering\*\***

**FIG. 21C**

Router A		Router B	
Multicast Group	Next Hop Links	Multicast Group	Next Hop Links
224.1.2.1	L1,L3	224.1.2.3	L2,L3
224.1.2.3	L2	224.1.2.5	L4
224.1.2.4	L1,L3	224.1.2.9	L2,L3
224.1.2.8	L3		
224.1.2.9	L2		

FIG. 22

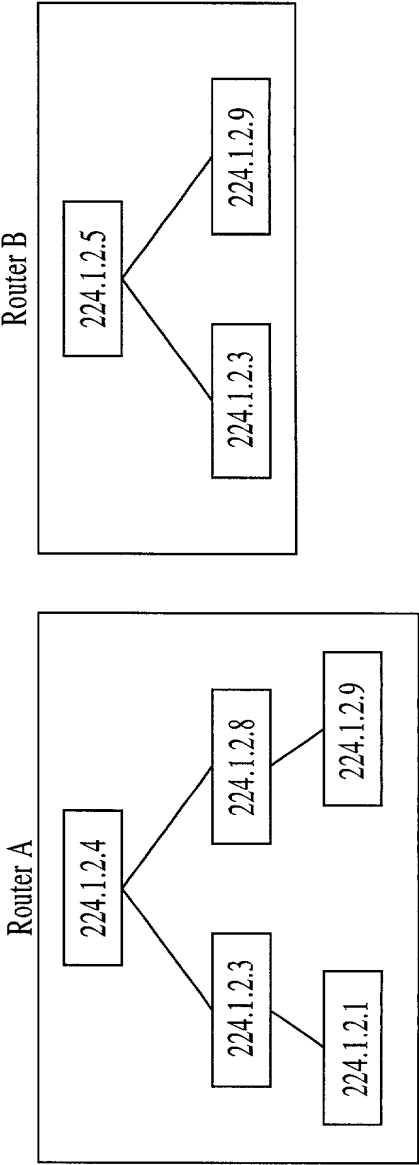


FIG. 23

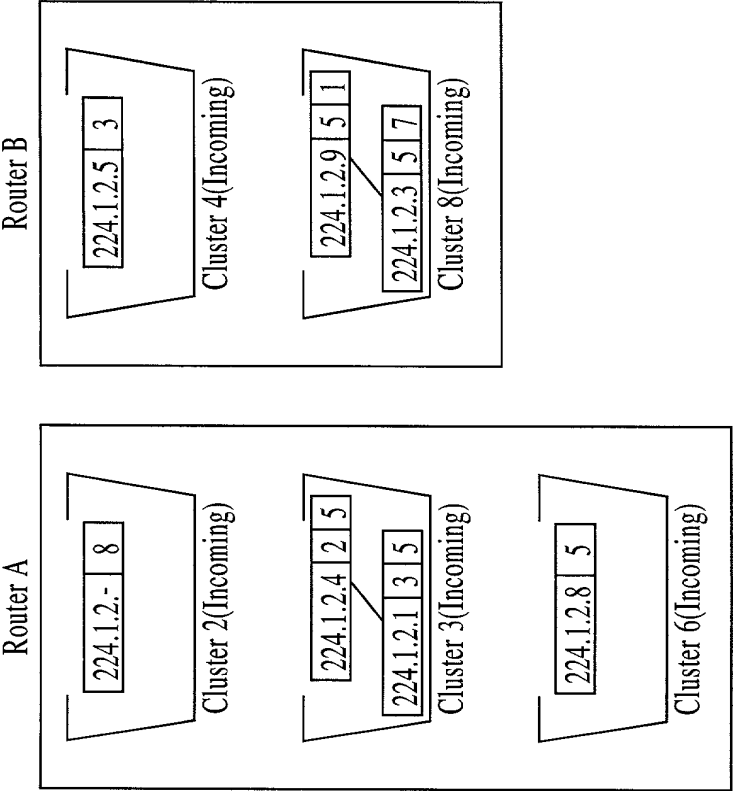


FIG. 24

Outgoing Links	Cluster No. Incoming
L1	1
L2	2
L3	3
L1,L2	4
L1,L3	5
L2,L3	6

FIG. 25



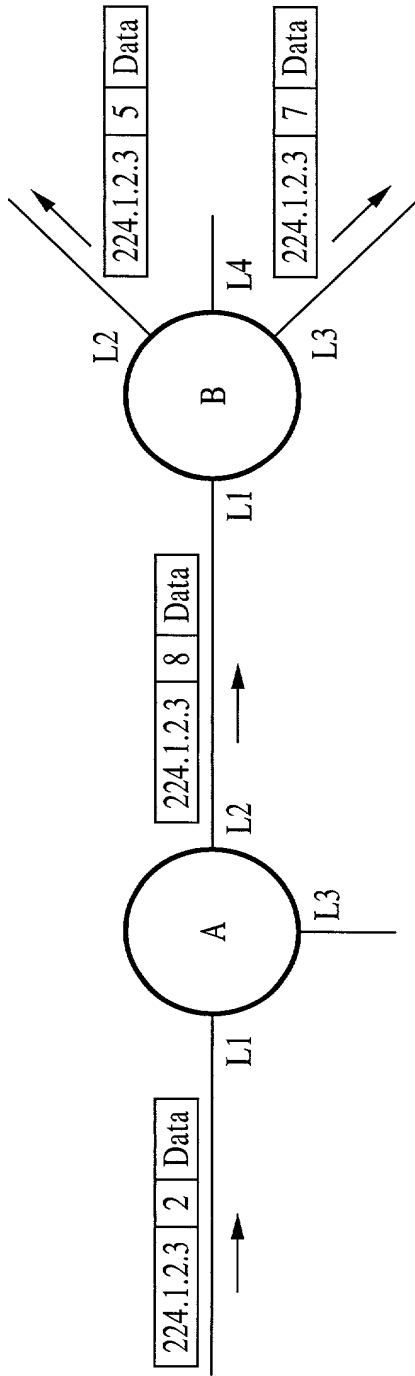


FIG. 26

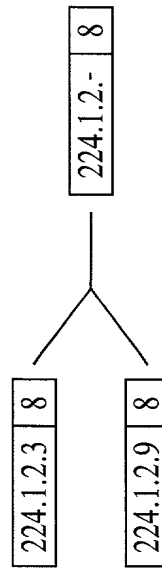


FIG. 27

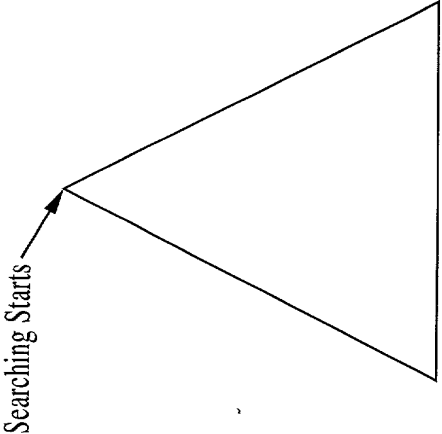


FIG. 28

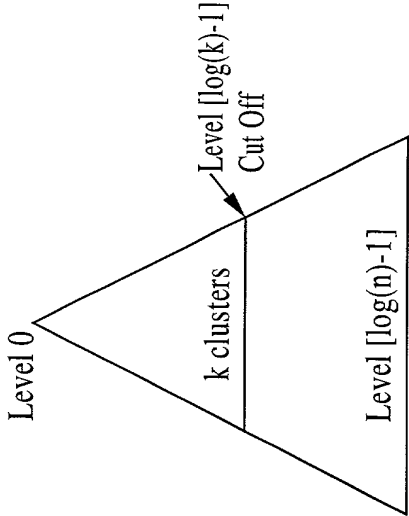


FIG. 29

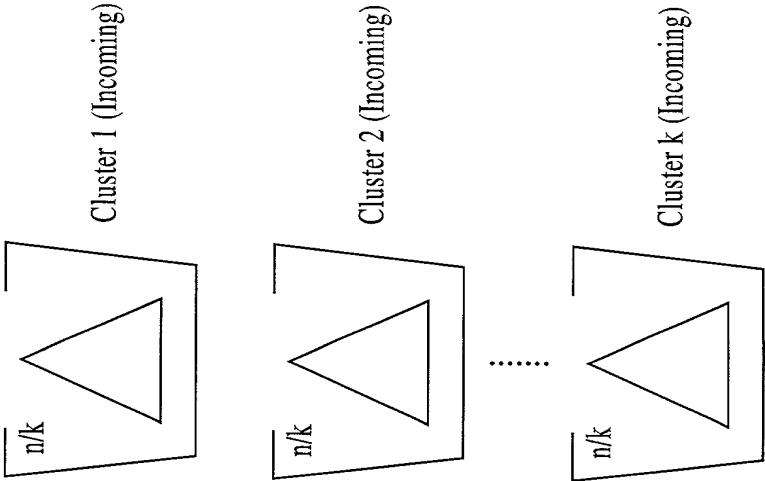


FIG. 30

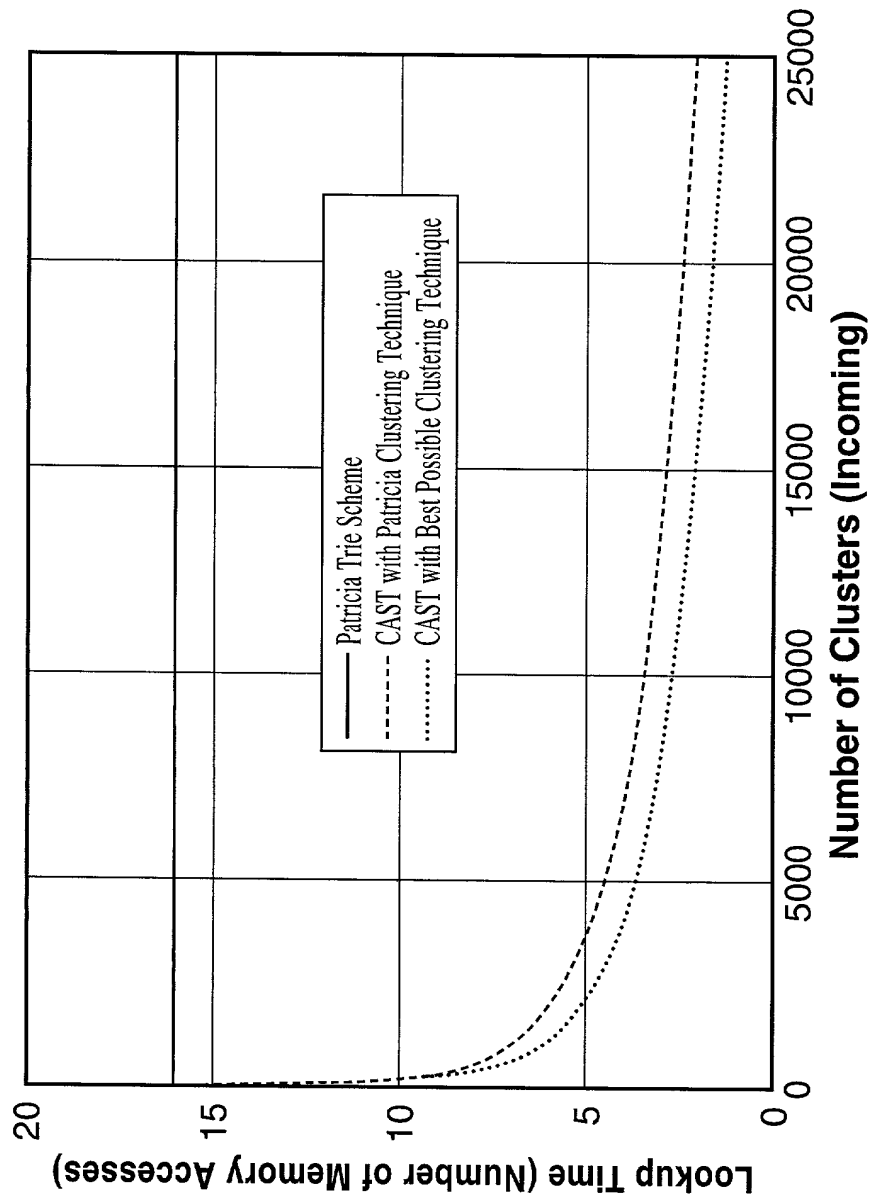


FIG. 31

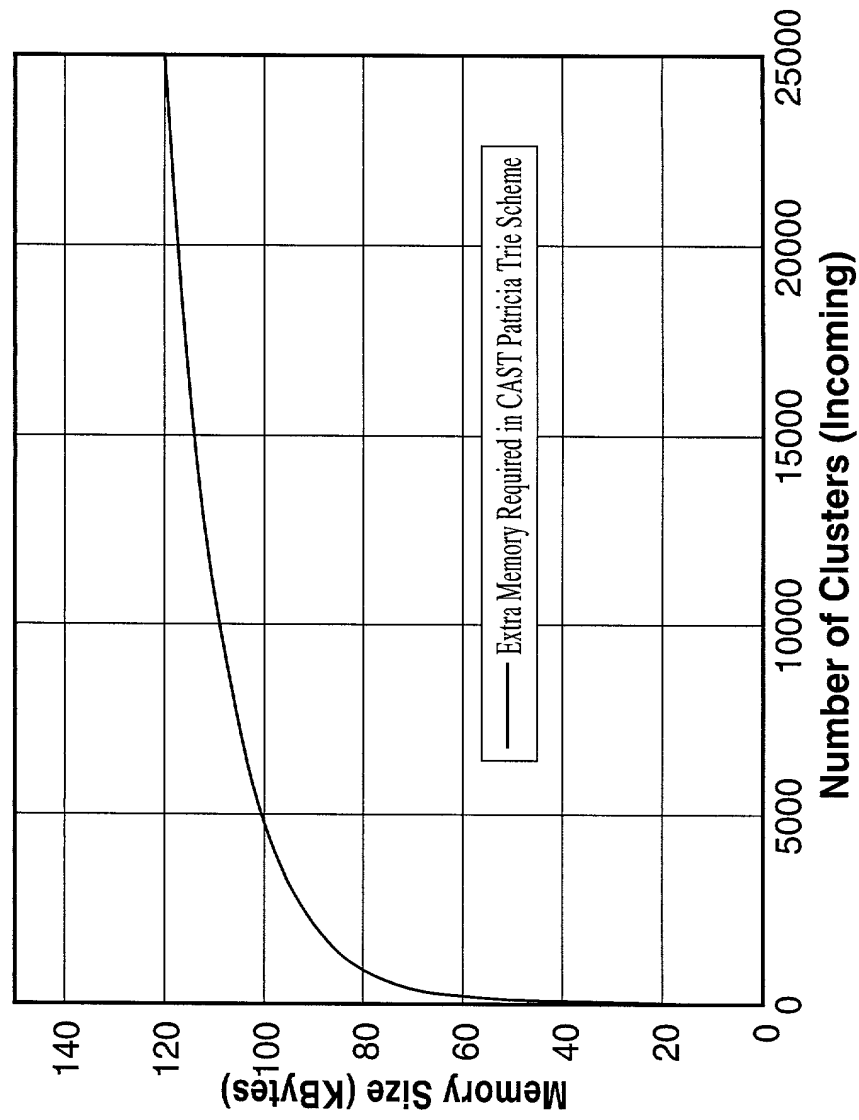


FIG. 32

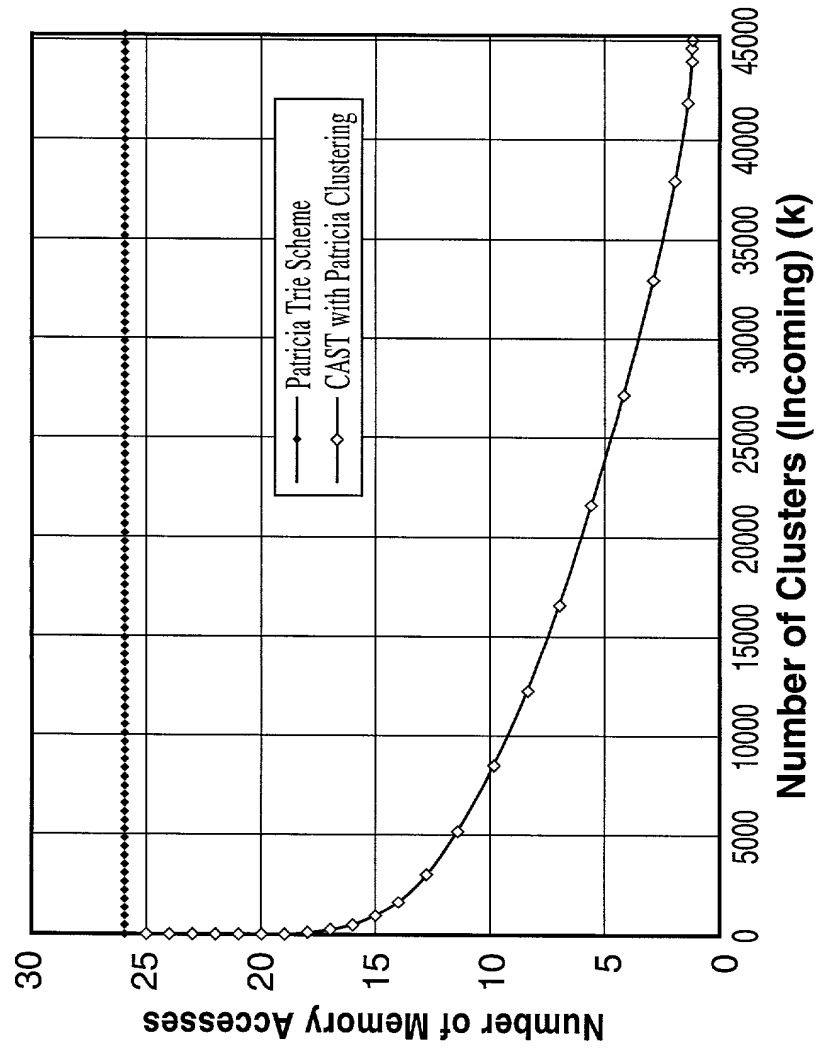


FIG. 33

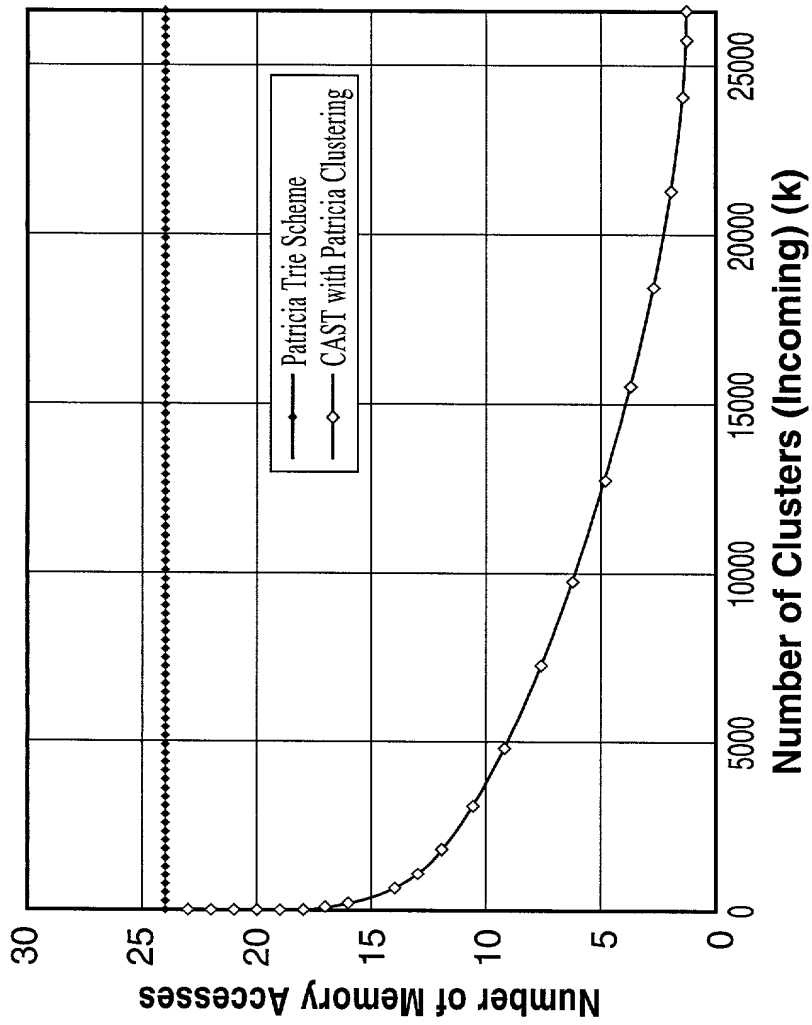


FIG. 34

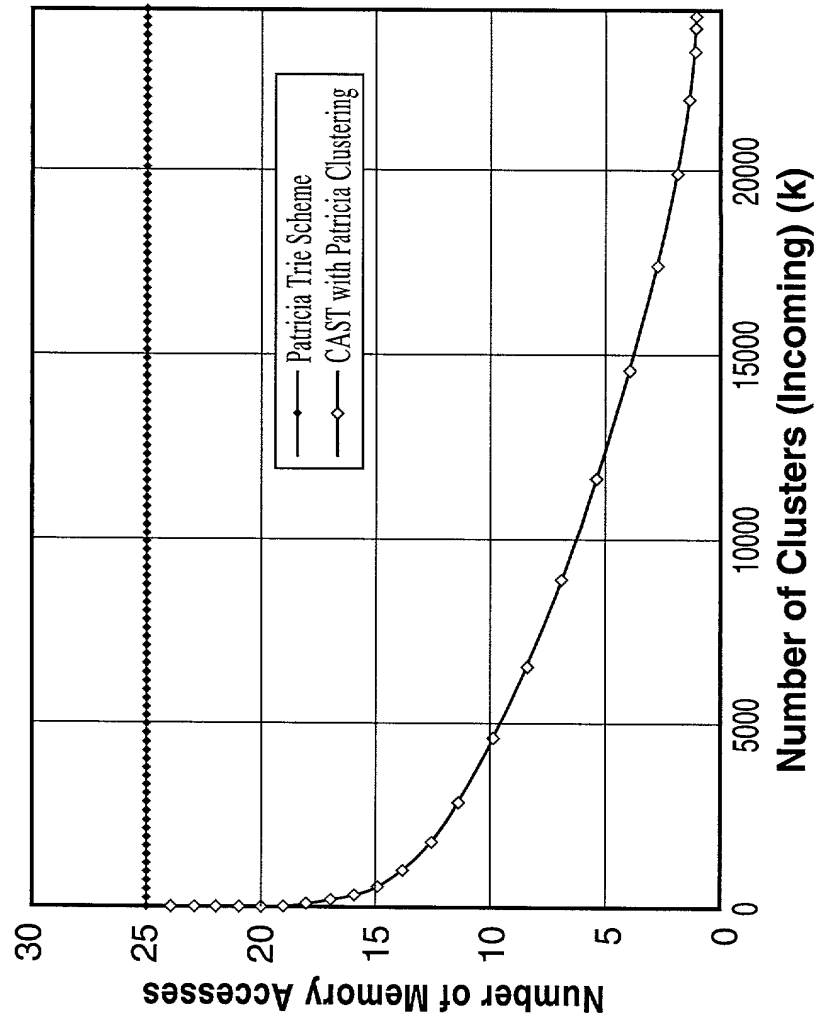


FIG. 35

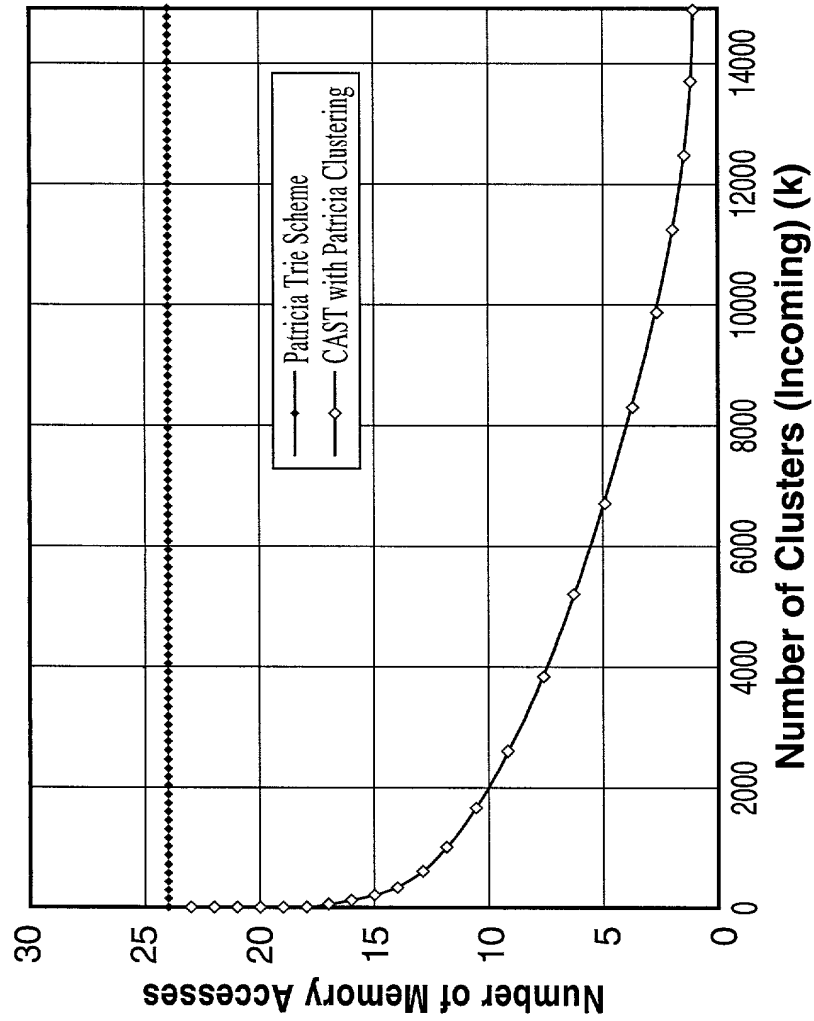
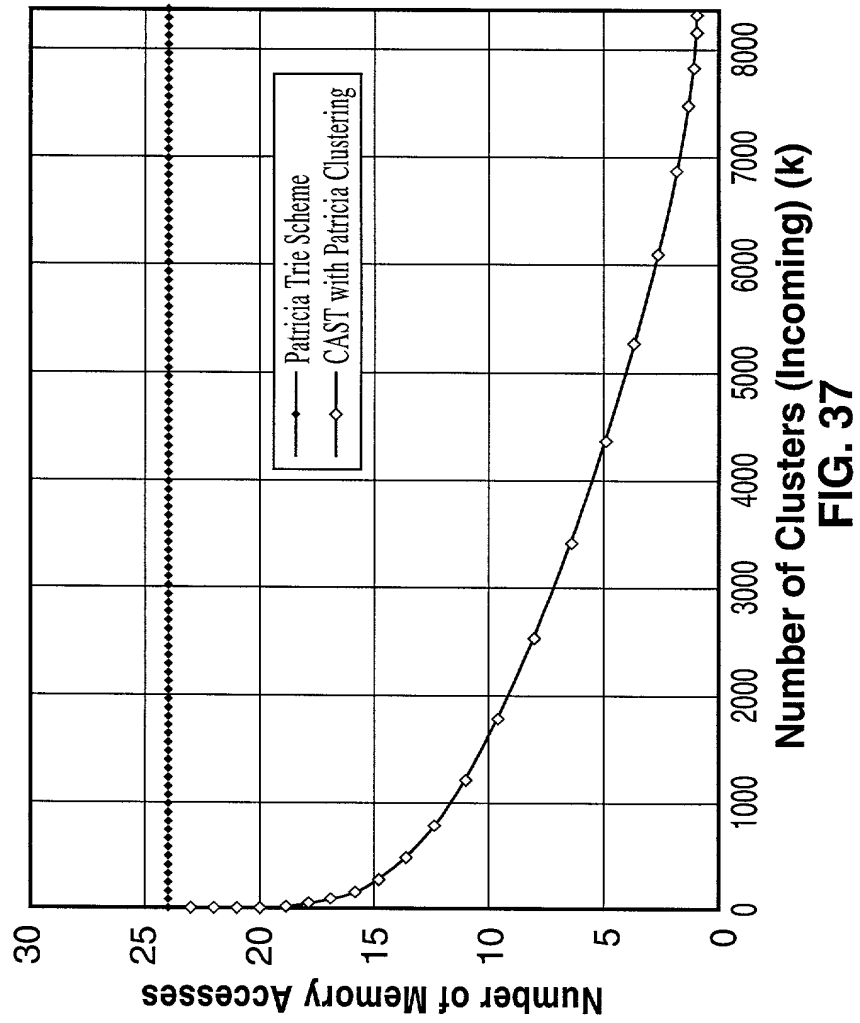


FIG. 36





Actual Implementation Results						
Scheme	Lookup Power (MPPS)					
	MAE-EAST	MAE-WEST	PAC-BELL	AADS	PAIX	
Patricia Trie	0.75	0.90	1.95	1.13	1.02	
LPC	2.12	2.41	2.90	3.53	4.17	
CAST (Patricia)	4.89	5.03	6.32	6.53	7.81	
CAST (Symmetric)	0.92	1.07	2.19	1.26	1.25	
CAST (Link)	0.96	1.11	2.20	1.27	1.27	

FIG. 38

Multicast Results (40,000 Entries)						
Scheme	Lookup Power			Memory (KBytes)	Update Time (Memory Accesses)	
	Maximum (Memory Accesses)	Average (Memory Accesses)	Lookup Power (MPPS)			
AVL Tree	16	15.21	1.31	1026	15.21	
Tag Switching	1	1.00	20.00	1040	15.24	
IP Switching	16	2.42	8.26	1862	30.43	
CAST (Link clustering, 2048 Clusters(In.))	7	4.17	23.98	889	15.18	

FIG. 39

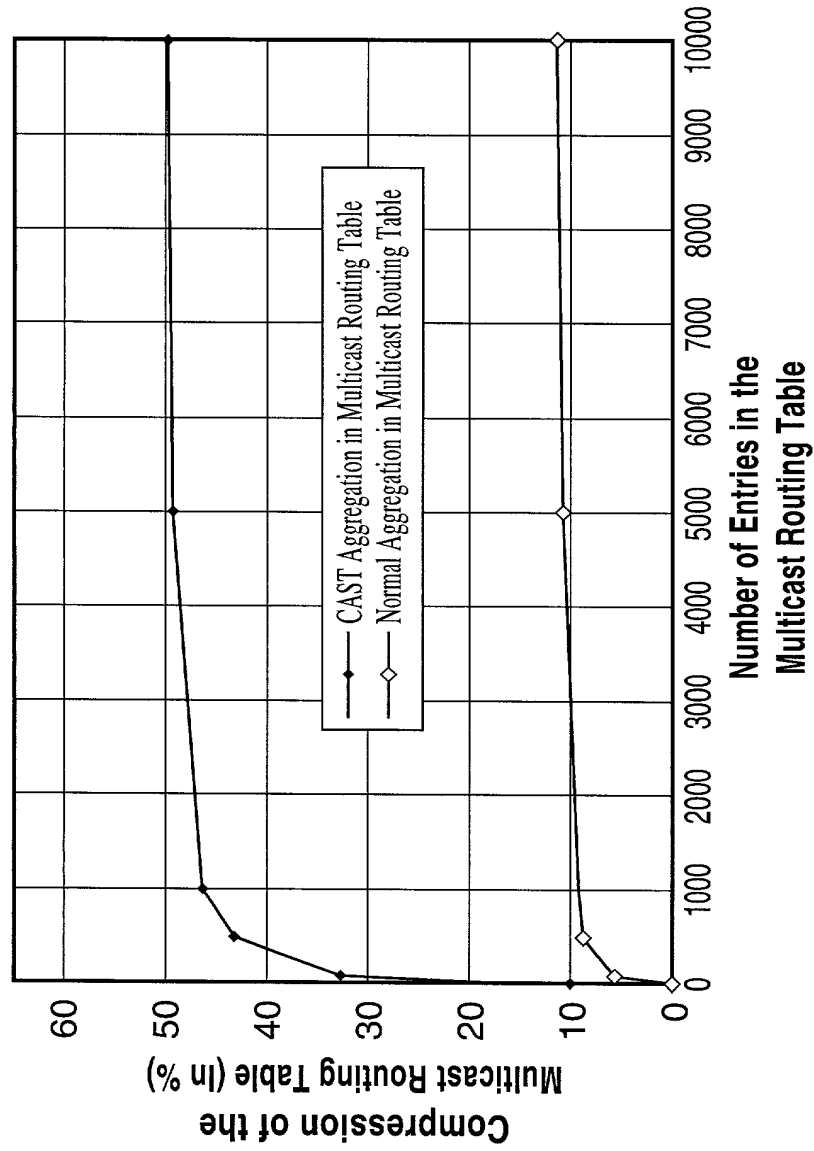


FIG. 40

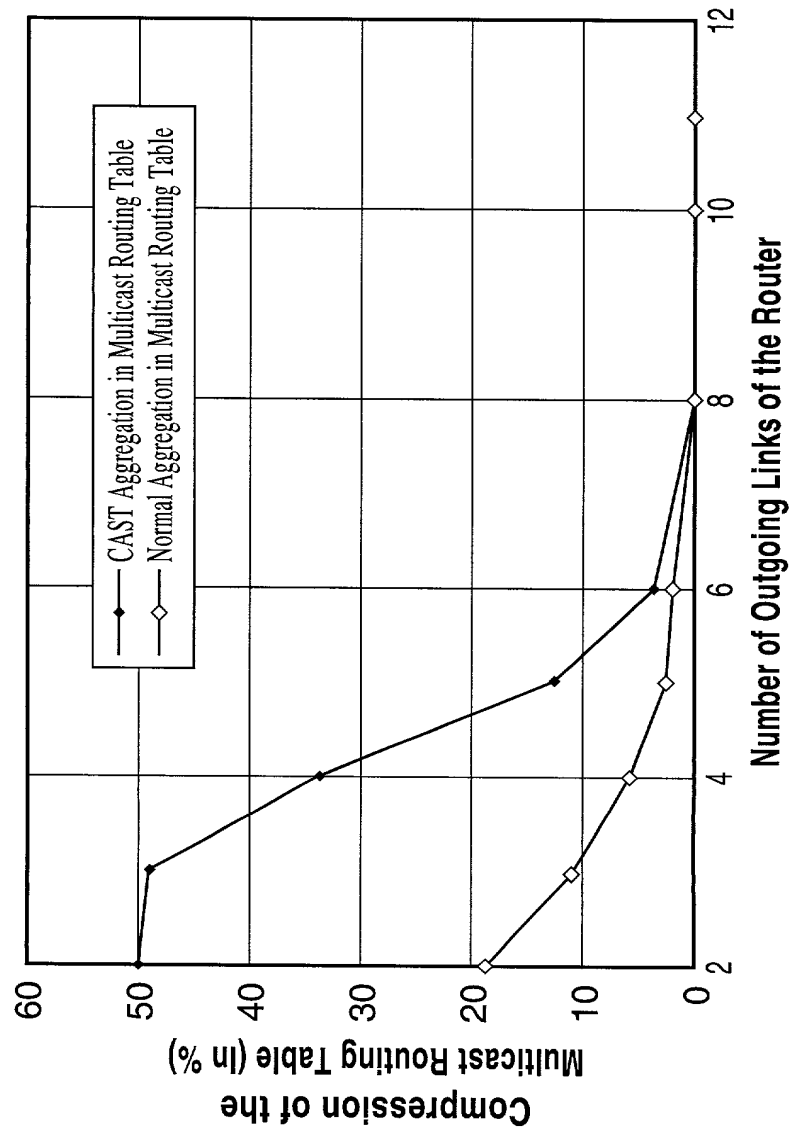


FIG. 41